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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

HORNING, JOEL G

ART UNIT

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/583,942	Applicant(s) SAKURAI ET AL.	
	Examiner JOEL G. HORNING	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>06-22-06;09-22-09;02-07-07</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Claim Objections

1. **Claim 10** is objected to because of the following informalities: though in the original claim it was correct, as amended the claim still refers to "metal compounds," though only one compound is now taught to be in the material. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
2. **Claims 1, 2, 4-6, 9, 13, 14, 18 and 19** are rejected under 35 U.S.C. 102(b) are rejected under 35 U.S.C. 103(a) as being unpatentable over Rhee et al (US 6274195, as cited by applicant).

The instant claim 1 requires a metal compound of the formula I, where: the metal is lead, titanium or zirconium.

Rhee et al teaches such a molecular formula which makes applicant's claimed molecule readily apparent, where: the metal is titanium (**claims 4 and 18**) or zirconium (**claims 5 and 19**), R_1 through R_4 can be C_{1-4} alkyl groups (in the carbon bonded to the oxygen) or Hydrogen (in the "A" carbons), and A can a methylene group ($m=2$) (**claim 2**) and $n=4$ (**claim 1**). This molecule is used as a precursor material for MOCVD of metal compound thin films (**claim 6**) (abstract).

Thus applicant's claimed compound would have been obvious to a person of ordinary skill in the art at the time of invention based upon the teaching of Rhee et al.

3. Regarding **claims 9, 13 and 14**, Rhee et al teaches that in order to deposit metal compound films from the precursors by MOCVD, the precursors are vaporized, then brought to the surface of a substrate, where they chemically react, thus forming the thin film (col 1, lines 33-38).
4. **Claims 1-19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Desu et al (US 5431958) in view of Jones (WO 03/035926, as supplied by applicant).

Desu et al teaches metallorganic alkoxide compounds are common precursors for the growth of lead zirconate titanate (PZT) metal oxide films by MOCVD (col 4, lines 31-35). It teaches that lead alkoxides, such as lead t-butoxide are known precursors, though they suffer from hydrolysis issues (water sensitivity) (col 5, lines 41-45). Desu et al does not teach using the specific lead alkoxide doped with an amino group claimed by applicant.

However, Jones is also directed towards vapor deposition precursors (generally, as well as some metals specifically) (page 1, paragraph 1). It teaches that metal alkoxide ligands are desirable for precursor compounds, but they have some undesirable properties. Specifically t-butoxide is used as a ligand, but it is highly moisture sensitive (page 4, paragraph 3 teaches that it is susceptible to hydrolysis), which causes it to be less stable and have a short shelf life (page 2). In order to overcome this undesired property of the ligand, Jones teaches the use of donor stabilized alkoxy ligands instead, including amine stabilized alkoxides which read on applicant's claimed ligands. The case where R^1 and R^2 are alkyl groups, from which C₁-C₄ is readily apparent, and X is NR^2 . The use of these ligands increases the stability of the organometallic (page 3, paragraphs 2-4).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to substitute the t-butoxide ligands of the lead precursor compounds of Desu et al with the amine donor functionalized ligands of Jones in order to reduce the water sensitivity (susceptability to hydrolysis) and instability of the organometallic and thus produce a precursor with a longer shelf life, which is less likely to react prematurely (**claims 1 and 3**).

5. Regarding **claims 2 and 17**, in this precursor molecule, "A" is a methylene group.
6. Regarding **claims 7, 10 and 12**:

Desu et al teaches that in MOCVD for PZT, a lead precursor, a zirconium precursor and a titanium precursor are vaporized using bubblers (col 6, lines 11-41) and mixed in the precursor line (see figure 2), forming a vaporous precursor material

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of the three precursors which the substrate is then exposed to, causing the deposition of the PZT film (which it is readily apparent would require that the precursors actually decompose) (col 7, lines 10-21).

MPEP 2144.04 (IV) states: "selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results." Thus it would have been obvious to a person of ordinary skill in the art to mix the precursors before vaporizing them instead of afterwards.

Desu et al further teaches that tetra(tert-butoxy) titanium and tetra(tert-butoxy) zirconium are known MOCVD precursors for those metals (col 5, lines 25-30).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to use tetra(tert-butoxy)titanium and tetra(tert-butoxy)zirconium together with the lead compound of claim 3 in the described MOCVD process for the deposition of PZT, which would include mixing them together into a material, vaporizing them, exposing them to the substrate, where they decompose to form the PZT film since they were known precursors for those metals for the deposition of PZT which would produce predictable results (**claims 10 and 12**).

As just described, Desu teaches t-butoxy titanium and zirconium compounds as precursors, but does not teach using amino donor functionalized alkoxy titanium and zirconium precursors of formula I as required by claim 7.

However, as discussed previously Jones teaches that t-butoxide precursors for titanium and zirconium are susceptible to hydrolysis and are highly water sensitive. In order to overcome these issues, it teaches substituting t-butoxide

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zirconium and titanium precursors with precursors which read on applicant's claimed compounds. The case where R^1 and R^2 are alkyl groups, from which C_1-C_4 is readily apparent, X is NR^2 , and $x=0$ (**claims 2, 4, 5, 18 and 19**). These compounds are taught to be less water sensitive and susceptible to hydrolysis than the t-butoxy compounds (page 3, paragraphs 2-4).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to substitute the t-butoxide titanium and zirconium precursor compounds of Desu et al in the process for depositing PZT with the titanium and zirconium compounds of Jones, which read upon formula I, in order to reduce the water sensitivity (susceptibility to hydrolysis) and instability of the organometallic precursors and thus produce a precursor with a longer shelf life, which is less likely to react prematurely (**claims 6, 7, 9 and 13-15**).

7. Regarding **claims 8, 11 and 16**, Desu et al does not teach using tetrakis(1-methoxy-2-methyl-2-propoxy) titanium and zirconium compounds in the PZT deposition process.

However, as discussed previously, Jones teaches that tetrakis(t-butoxide) precursors for titanium and zirconium are susceptible to hydrolysis and are highly water sensitive, and thus teaches using (1-methoxy-2-methyl-2-propoxy) compounds of titanium and zirconium to produce more stable precursors (page 3, paragraphs 2-3). Specifically tetrakis(1-methoxy-2-methyl-2-propoxy)titanium (page 11) and tetrakis(1-methoxy-2-methyl-2-propoxy)zirconium (page 7) compounds are taught as precursors of this form.

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Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to substitute the titanium and zirconium tetrakis (t-butoxide) precursor compounds with the tetrakis(1-methoxy-2-methyl-2-propoxy) forms of these compounds in order to improve the precursors' shelf lives and reduce the processes sensitivity to hydrolysis and water **(claims 8, 11 and 16)**.

Conclusion

8. No current claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOEL G. HORNING whose telephone number is (571) 270-5357. The examiner can normally be reached on M-F 9-5pm with alternating Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael B. Cleveland can be reached on (571)272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. G. H./
Examiner, Art Unit 1792

/Michael Cleveland/
Supervisory Patent Examiner, Art Unit 1792